PPM-91-587

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UNISYS

(74)

Interoffice Memorandum

A. Sharma
Department
Code 716
From
K. Sahu KS
Department
7809
Subject
Radiation Report on GPEP/PPL
Part Nos. 2299000-1,-2

PPM-91-587
Date
September 20, 1991
Division
GSFC
Telephone
731-8954
Location
Lanham

S. Archer-Davies
N. Virmani
T. Perry

A radiation evaluation was performed on 2299000-1 and 2299000-2 to determine the total dose tolerance of these parts. A brief summary of the test results is provided below. For detailed information, refer to Tables I through IV and Figure 1.

The total dose testing was performed using a cobalt-60 gamma ray source. During the radiation testing, four parts (two of each part type) were irradiated under bias (see Figure 1 for bias configuration), and two parts (one of each type) were used as control samples. The total dose radiation steps were 25, 50, 100, 300, 600 and 1000 krads. After 1000 krads, parts were annealed at 25°C for 120 and 168 hours (cumulative). The dose rate was between 1.3 - 9.1 krads/hour, depending on the total dose level (see Table II for radiation schedule). After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits listed in Table III.

Three of the four irradiated parts passed all tests on irradiation to 1Mrads and subsequent annealing at 25°C. One part, SN 212 - 2299000-2, marginally failed VOL3 after the final cumulative exposure of 1Mrads (the VOL3 reading was 408mV against the maximum specification limit of 400mV). However, this part passed after both annealing treatments. All parts passed functionally at all radiation and annealing steps. Table IV provides the mean and standard deviation values for each parameter after different radiation exposures and annealing treatments.

Any further details about this evaluation can be obtained upon request. If you have any questions, please call me at (301) 731-8954.

TABLE I. Part Information

Generic Part Number:	2299000
GPEP/PPL Part Numbers:	2299000-1,-2
GPEP/PPL Control Numbers:	4706 (2299000-1) 4707 (2299000-2)
Charge Number:	C14500
Manufacturer:	Teledyne MicroElectronics
Lot Date Codes:	9106, 9109, 9111, 9047, 9049
Quantity Tested:	6
Serial Numbers of Radiation Samples:	201 (LDC 9109, PN 2299000-1) 202 (LDC 9111, PN " -1) 211 (LDC 9109, PN " -2) 212 (LDC 9106, PN " -2)
Serial Numbers of Control Samples:	200 (LDC 9049, PN 2299000-1) 210 (LDC 9047, PN 2299000-2)
Part Function:	64k x 16 SRAMs
Part Technology:	CMOS
Package Style:	92-Pin DIP
Test Engineer:	J. Lander

128K x 8 ← verify. if this is correct how are they configured? 128K x 8-bit?

TABLE II. Radiation Schedule for 2299000-1,-2

EVENTS	DATE
1) Initial Electrical Measurements	08/20/91
2) 25 krads irradiation @ 1250 rads/hr	08/20/91
Post 25 krads Electrical Measurements	08/21/91
3) 50 krads irradiation @ 1250 rads/hr	08/21/91
Post 50 krads Electrical Measurements	08/22/91
4) 100 krads irradiation @ 2630 rads/hr	08/22/91
Post 100 krads Electrical Measurements	08/23/91
5) 300 krads irradiation @ 3300 rads/hr	08/23/91
Post 300 krads Electrical Measurements	08/26/91
6) 600 krads irradiation @ 6800 rads/hr	08/26/91
Post 600 krads Electrical Measurements	08/28/91
7) 1 MRad irradiation @ 9100 rads/hr	08/28/91
Post 1 MRad Electrical Measurements	08/30/91
8) 120 hour annealing	08/30/91
Post 120 hr Electrical Measurements	09/04/91
9) 168 hour annealing	08/30/91
Post 168 hr Electrical Measurements	09/06/91

Notes:

- All parts were radiated under bias at the cobalt-60 gamma ray facility at GSFC.
- All electrical measurements were performed off-site at 25°C.
- Annealing performed at 25°C under bias.

Table III. Electrical Characteristics of 2299000-1,-2

FUNCTIONAL TESTS						
PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS 25C,-55C & 125C
FUNCT # 1	5.0V	0.0V	5.0V	FREQ =6.25MHz	ALL I/O	VOL<1.5V , VOH>1.5V
FUNCT # 2	5.0V	0.0V	5.0V	FREQ =6.25MHz	ALL I/O	VOL<1.5V , VOH>1.5V
FUNCT # 3	5.0V	0.0V	5.0V	FREQ =2.00MHz	ALL I/O	VOL<1.5V , VOH>1.5V
FUNCT # 4	5.0V	0.0V	5.0V	FREQ =2.00MHz	ALL I/O	VOL<1.5V , VOH>1.5V

DC PARAMETRIC TESTS						
PARAMETER	VCC	VIL	VIH	CONDITIONS	PINS	LIMITS 25C, 55C & 125C
VIH_5.5V	5.5V	0.0V	0.8V	FREQ= 2MHZ	INS	>+0.8V , <+2.0V
VIL_4.5V	4.5V	2.0V	4.5V	FREQ= 2MHZ	INS	>+0.8V , <+2.0V
VOH1	4.5V	0.8V	2.0V	LOAD= -0.3MA	OUTS	>+2.4V , <+5.5V
VOH2	4.5V	0.0V	4.5V	LOAD= -4.0MA	OUTS	>+2.4V , <+5.5V
VOH3	4.5V	0.0V	4.5V	LOAD= -8.0MA	OUTS	>+2.4V , <+5.5V
VOL1	4.5V	0.8V	2.0V	LOAD= +0.3MA	OUTS	> 0.0V , <+0.2V
VOL2	4.5V	0.0V	4.5V	LOAD= +4.0MA	OUTS	> 0.0V , <+0.4V
VOL3	4.5V	0.0V	4.5V	LOAD= +8.0MA	OUTS	> 0.0V , <+0.4V
IIH	5.5V	0.0V	5.5V	VIN = 5.5V	INS	>-10UA , <+10UA
IIL	5.5V	0.0V	5.5V	VIN = 0.0V	INS	>-10UA , <+10UA
IOZH	5.5V	0.0V	5.5V	VOUT= 5.5V	OUTS	>-30UA , <+30UA
IOZL	5.5V	0.0V	5.5V	VOUT= 0.0V	OUTS	>-30UA , <+30UA
ICCSB	5.5V	0.0V	5.3V	DISABLED OUT	VCC	> 0.0MA , <+8MA
ICCD	5.5V	0.0V	5.3V	FRQ = 1 MHZ	VCC	> 0.0MA , <+80MA
ICCX	5.5V	0.0V	5.3V	F=2MHZ,1K BLK	VCC	> 0.0MA , <+8MA

AC PARAMETRIC TESTS						
PARAMETER	VCC	VIL	VIH	CONDITIONS	OUTPINS	LIMITS 25C,-55C & 125C
TAA1_LH	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U1 ,U9	> 0ns , < 110ns
TAA1_HL	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U1 ,U9	> 0ns , < 110ns
TAA2_LH	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U2 ,U10	> 0ns , < 110ns
TAA2_HL	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U2 ,U10	> 0ns , < 110ns
TAA3_LH	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U3 ,U11	> 0ns , < 110ns
TAA3_HL	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U3 ,U11	> 0ns , < 110ns
TAA4_LH	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U4 ,U12	> 0ns , < 110ns
TAA4_HL	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U4 ,U12	> 0ns , < 110ns
TAA5_LH	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U5 ,U13	> 0ns , < 110ns
TAA5_HL	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U5 ,U13	> 0ns , < 110ns
TAA6_LH	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U6 ,U14	> 0ns , < 110ns
TAA6_HL	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U6 ,U14	> 0ns , < 110ns
TAA7_LH	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U7 ,U15	> 0ns , < 110ns
TAA7_HL	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U7 ,U15	> 0ns , < 110ns
TAA8_LH	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U8 ,U16	> 0ns , < 110ns
TAA8_HL	4.5V	0.0V	3.0V	F=1.0MHz,VCMP=1.5V	U8 ,U16	> 0ns , < 110ns

Comments and Exceptions for Table III

(1) FUNCTIONAL TESTS ARE PERFORMED AT VCC=5.0V ONLY.

(2) FUNCTIONAL TESTS #1 & #3 CONSISTS OF THE FOLLOWING PATTERNS :

1 - ALL_ONES	2 - ALL_ZEROS
3 - CHECKERBOARD	4 - INVERSED CHECKERBOARD

(3) FUNCTIONAL TESTS #2 & #4 CONSISTS OF THE FOLLOWING APG PATTERNS :

1 - "1ON" MARCH	2 - ROW_ADDRESS
3 - COL_ADDRESS	4 - SLIDING_DIAGONALLY
5 PING_PONG	6 SURROUND
7 - ROW_GALPAT	8 - COL_GALPAT

(4) VIL & VIH WERE TESTED DYNAMICALLY @ 2MHZ FUNCTIONAL AND GO/NOGO DURING VOH1 & VOL1 DC TESTS.

(5) ICCX : STAND BY QUIESCENT CURRENT MEASUREMENT FOR EVERY 1024 ADDRESS LOCATIONS. CONSIST OF THE FOLLOWING PROCEDURE :
- (a) - WRITE ZEROES (ALL ADDRESSES).
- (b) - WRITE ONES TO THE FIRST 1024 ADDRESSES.
- (c) - PERFORM AN ICCSB MEASUREMENTS.
- (d) - WRITE ZEROES TO THE FIRST 1024 ADDRESSES.
- (e) - REPEAT STEPS (b)->(d) FOR THE NEXT 1024 ADDRESSES AND SO ON, FOR A TOTAL OF 64 READINGS (64K ADDRESSES).

(6) TESTS NOT PERFORMED :
- WRITE/READ CYCLE TIMING PERFORMED GO/NOGO @ 6.25MHz (FUNCT #1 & #2).
- ONLY ADDRESS ACCESS TIME PROP. DELAYS WERE PERFORMED (TAA TESTS).
- ALL OTHER AC TESTS ARE NOT BEING PERFORMED WITHIN THIS PROGRAM.

(7) THIS PROGRAM TESTS FOR CONTINUITY AND OPPOSITE STATE VOL OR VOH TEST.

TABLE IV: Summary of El cal Measurements
after Total Dose Exposures and Annealing for 2299000-1,-2 1/, 2/

					Total Dose Exposure (krads)												Annealing	
			Initials		25		50		100		300		600		1000		168 hrs	
	Spec. Limits																	
Parameters	min	max	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Func1 @6.25MHz			Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
Func2 @6.25MHz			Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
Func3 @ 2MHz			Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
Func4 @ 2MHz			Pass		Pass		Pass		Pass		Pass		Pass		Pass		Pass	
VIH V	0.8	2.0	1.88	.06	1.87	.06	1.86	.06	1.86	.1	1.74	.06	1.73	.04	1.72	.04	1.75	.03
VIL V	0.8	2.0	1.58	.03	1.56	.02	1.55	.03	1.53	.03	1.44	.04	1.43	.01	1.40	.02	1.43	.02
VOH1 V	2.4	4.5	4.48	0	4.48	0	4.48	0	4.48	0	4.48	0	4.48	0	4.48	0	4.48	0
VOH2 V	2.4	4.5	4.34	.01	4.34	0	4.34	0	4.34	0	4.34	0	4.33	0	4.32	.03	4.33	0
VOH3 V	2.4	4.5	4.17	.01	4.18	.01	4.18	.01	4.18	.01	4.17	.01	4.16	.01	4.14	.05	4.16	.01
VOL1 mV	0	200	5	.7	5	.6	5	.5	5	.6	5	.6	5	.6	5	2	5	.5
VOL2 mV	0	400	80	2	77	2	77	2	76	2	75	2	76	2	83	28	77	2
VOL3 mV	0	400	164	4	158	4	157	4	156	4	154	4	154	5	169	54	157	5
IIH uA	-10	10	0	0	0	0	0	0	0	0	0	0	0	0	.03	.1	.01	.03
IIL uA	-10	10	0	.02	0	.01	0	.01	0	.01	0	.01	0	.01	0	.01	0	.01
IOZH uA	-30	30	0	0	0	0	0	0	0	0	0	0	0	0	.09	.15	.02	.05
IOZL uA	-30	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICCSB mA	0	8	.8	.07	.8	.06	.8	.06	.8	.06	.8	.07	.8	.03	.8	.03	8	.03
ICCD mA	0	80	40	5	40	5	40	5	40	5	39	5	39	5	39	5	39	5
ICCX mA	0	8	.8	.04	.8	.04	.8	.04	.7	.04	.8	.04	.8	.05	1.2	.5	1.0	.3

<Table IV continued on next page>

Table IV. (conti)

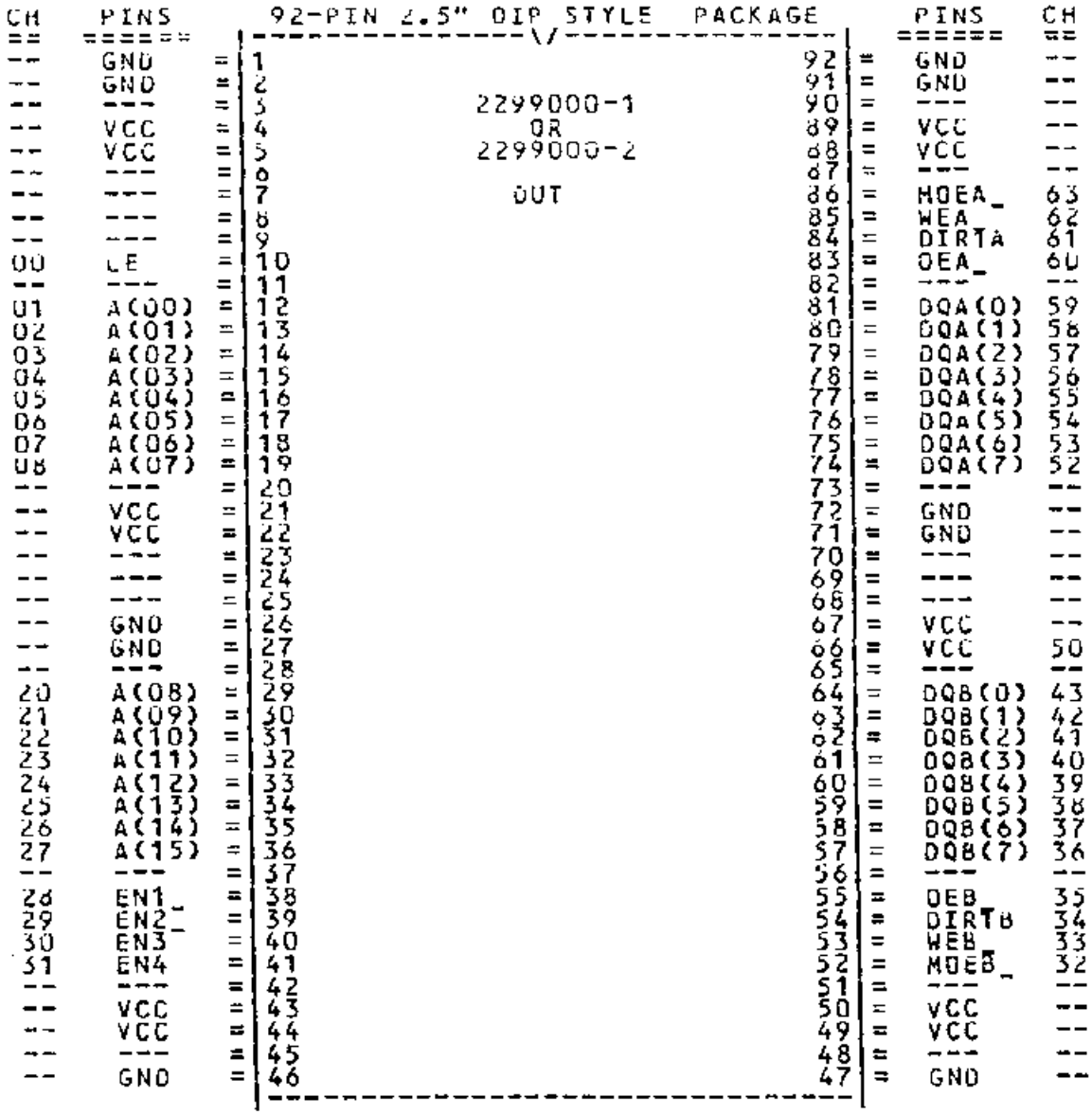
Parameters		Spec. Limits min	Spec. Limits max	Initials mean	Initials sd	Total Dose Exposure (krads) 25 mean	25 sd	50 mean	50 sd	100 mean	100 sd	300 mean	300 sd	600 mean	600 sd	1000 mean	1000 sd	Annealing 168 hrs mean	Annealing 168 hrs sd
TAA1_LH	ns	0	110	64	16	63	16	63	16	62	16	61	15	54	10	56	10	57	10
TAA1_HL	ns	0	110	46	3	45	3	46	3	47	4	53	9	57	13	57	15	59	14
TAA2_LH	ns	0	110	63	16	62	16	62	16	62	16	61	15	54	10	55	11	56	10
TAA2_HL	ns	0	110	46	3	45	4	45	4	46	4	52	9	56	13	57	15	58	14
TAA3_LH	ns	0	110	63	16	62	16	62	16	62	16	61	15	54	10	55	11	56	10
TAA3_HL	ns	0	110	46	3	45	3	45	4	46	4	52	9	57	13	57	15	59	14
TAA4_LH	ns	0	110	62	16	61	16	62	16	61	16	60	15	54	10	55	11	56	10
TAA4_HL	ns	0	110	46	3	45	4	45	4	46	4	51	9	56	13	57	15	59	14
TAA5_LH	ns	0	110	63	16	62	16	62	16	62	16	61	15	54	10	55	11	56	10
TAA5_HL	ns	0	110	46	3	45	3	45	3	45	3	52	9	57	13	55	15	57	15
TAA6_LH	ns	0	110	62	16	61	16	61	16	61	16	60	15	54	10	55	11	56	10
TAA6_HL	ns	0	110	46	3	45	3	45	4	45	3	51	9	56	13	55	15	57	15
TAA7_LH	ns	0	110	63	16	62	16	62	16	61	15	61	15	54	10	56	10	56	10
TAA7_HL	ns	0	110	46	3	45	3	45	3	45	3	52	9	57	13	55	15	57	15
TAA8_LH	ns	0	110	62	15	61	15	61	15	61	15	60	14	53	10	55	10	56	10
TAA8_HL	ns	0	110	45	3	45	3	45	4	45	3	51	9	56	13	55	15	56	15

Notes:

1/ The mean and standard deviation values were calculated over the four parts irradiated in this testing. The control samples remained constant throughout the testing and are not included in this table.

2/ Table IV does not contain post 120 hour electrical measurement data. This data is available and can be obtained upon request.

Figure 1. Radiation Bias Circuit for 2299000-1,-2



Notes for Radiation Bias Circuit

(1) VCC PINS CONNECTED TO POWER SUPPLY = 5.0V +/- 10%
GND PINS CONNECTED TO COMMON GROUND

(2)

A(00) , A(02) , A(04) , A(06)	CONNECTED TO GND	
A(08) , A(10) , A(12) , A(14)	CONNECTED TO GND	
A(01) , A(03) , A(05) , A(07)	CONNECTED TO VCC	THRU 2K OHM RESISTOR
A(09) , A(11) , A(13) , A(15)	CONNECTED TO VCC	THRU 2K OHM RESISTOR

(3)

DQA(00), DQA(02), DQA(04), DQA(06)	CONNECTED TO VCC/2	THRU 2K OHM RESISTOR
DQA(01), DQA(03), DQA(05), DQA(07)	CONNECTED TO VCC/2	THRU 2K OHM RESISTOR
DQB(00), DQB(02), DQB(04), DQB(06)	CONNECTED TO VCC/2	THRU 2K OHM RESISTOR
DQB(01), DQB(03), DQB(05), DQB(07)	CONNECTED TO VCC/2	THRU 2K OHM RESISTOR

(4)

EN1_ , EN2_	CONNECTED TO GND	
EN3_ , EN4_ , LE	CONNECTED TO VCC	THRU 2K OHM RESISTOR

(5)

MOEA_ , MOEB_ , WEA_ , WEB_	CONNECTED TO GND	
DIR1A , DIR1B , OEA_ , OEB_	CONNECTED TO VCC	THRU 2K OHM RESISTOR

(6) ALL RESISTOR ARE +/- 5% TO 10% AND 1/4W TO 1/2W

(7) TA SHALL BE AT ROOM AMBIENT OR 25oC +/- 5oC

(8) VCC/2 = 2.5V +/- 0.5V

Designed by : JUAN R LANDER 08/08/91

Approved by : ALIX DUVALSAINT 08/08/91